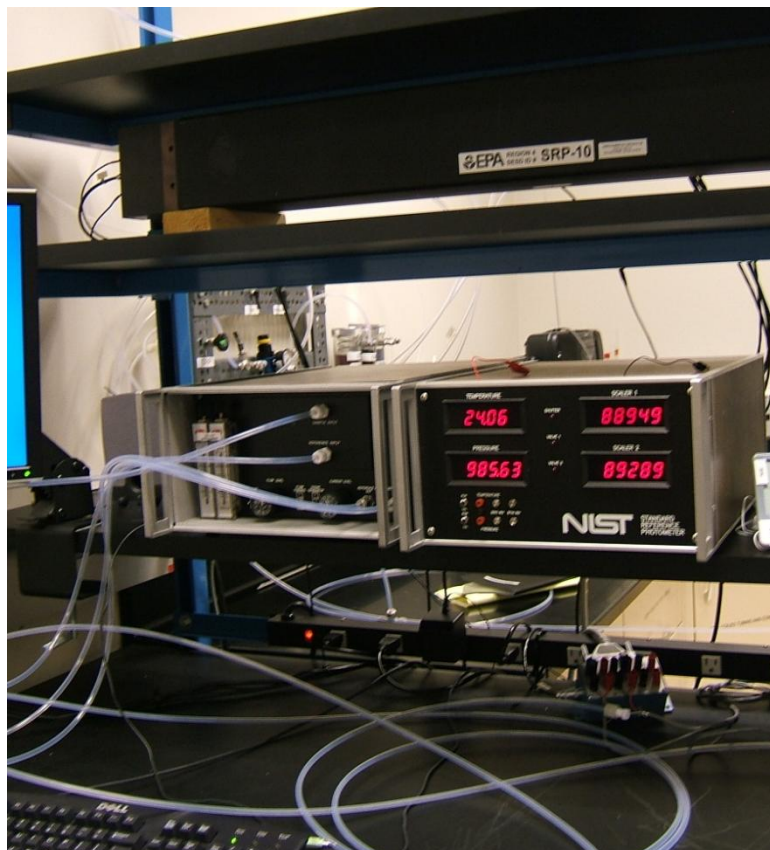


## **SRP Review**



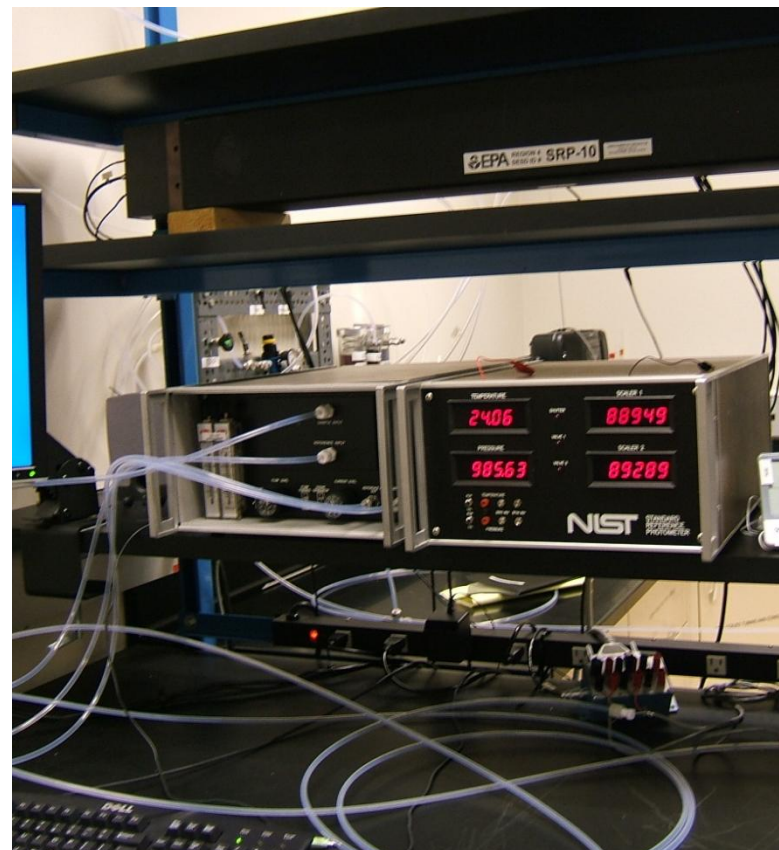
**Mike Crowe**

USEPA Region 4

Science and Ecosystem Support Division

## ***SRP Review***

Question: What year did the SRP come to Athens?



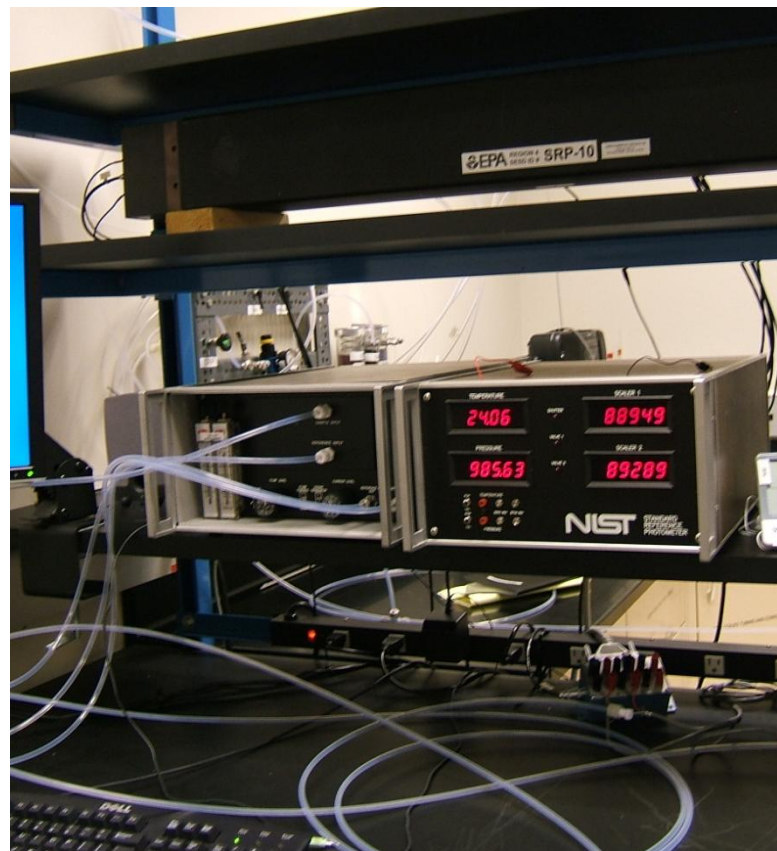
## ***SRP Review***

**Question: What year did  
the SRP come to Athens?**

**Answer:**

**It came to Athens in  
1987.**

**24 years ago!**



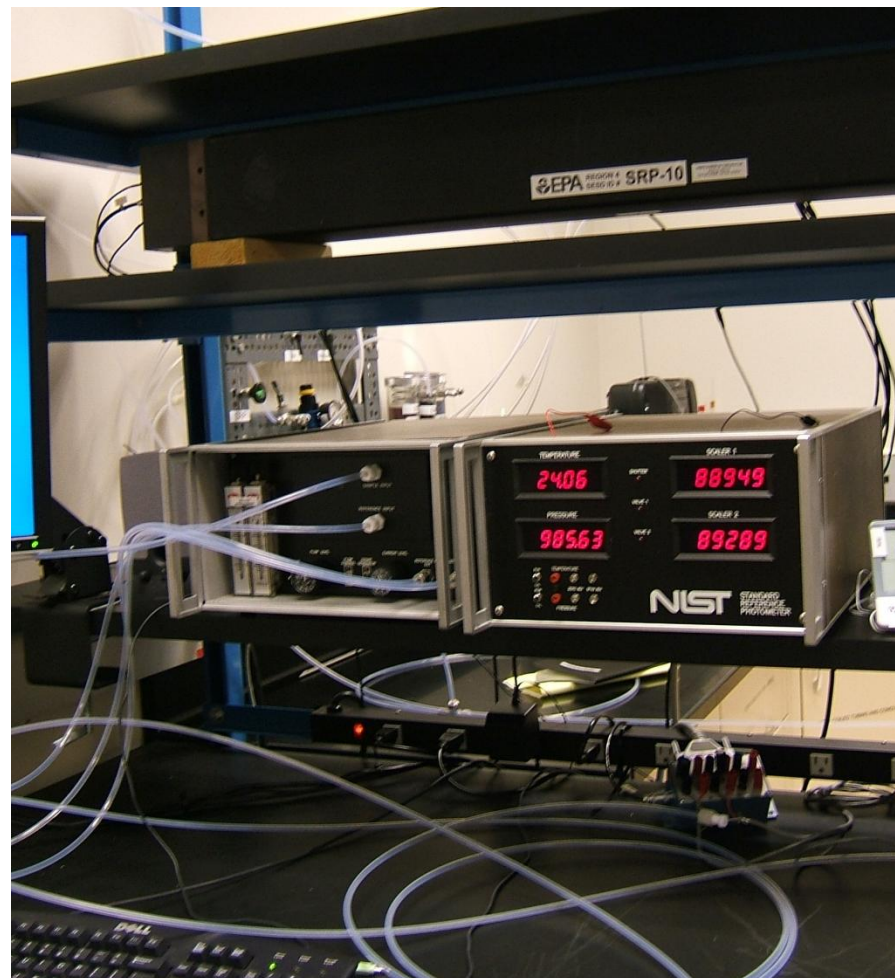
## ***SRP Review***

Question: What is it?

**S**

**R**

**P**

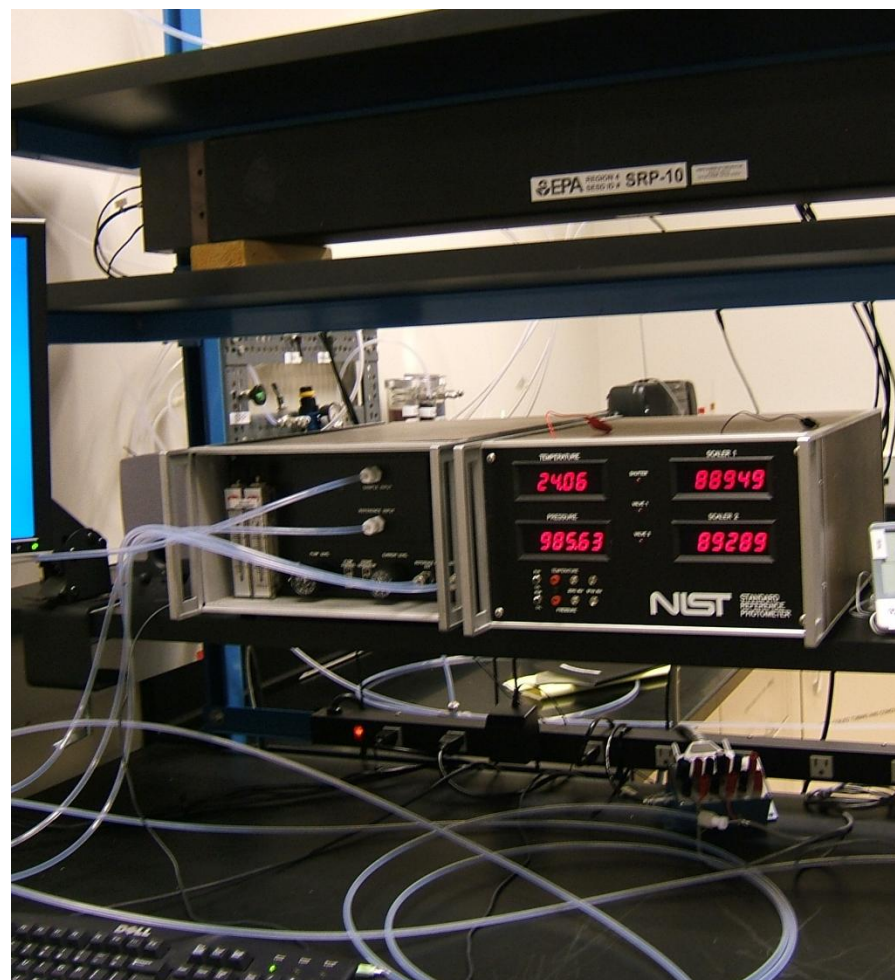




## ***SRP Review***

Question: What is it?

**Standard  
Reference  
Photometer**



## Background

Because of the instability of ozone ( $O_3$ ), the certification of  $O_3$  concentrations as Standard Reference Materials (SRMs) is impractical, if not impossible. Thus, when  $O_3$  concentration standards are required, they must be generated and certified locally.



## Background

Because of the instability of ozone ( $O_3$ ), the certification of  $O_3$  concentrations as Standard Reference Materials (SRMs) is impractical, if not impossible. Thus, when  $O_3$  concentration standards are required, they must be generated and certified locally.



***You can't have a tank of ozone.***

## Background

# NIST



- The SRP Program started in the early 1980s.
- The SRP Program is part of the **N**ational **P**erformance **E**valuation **P**rogram.



**Optical Bench**

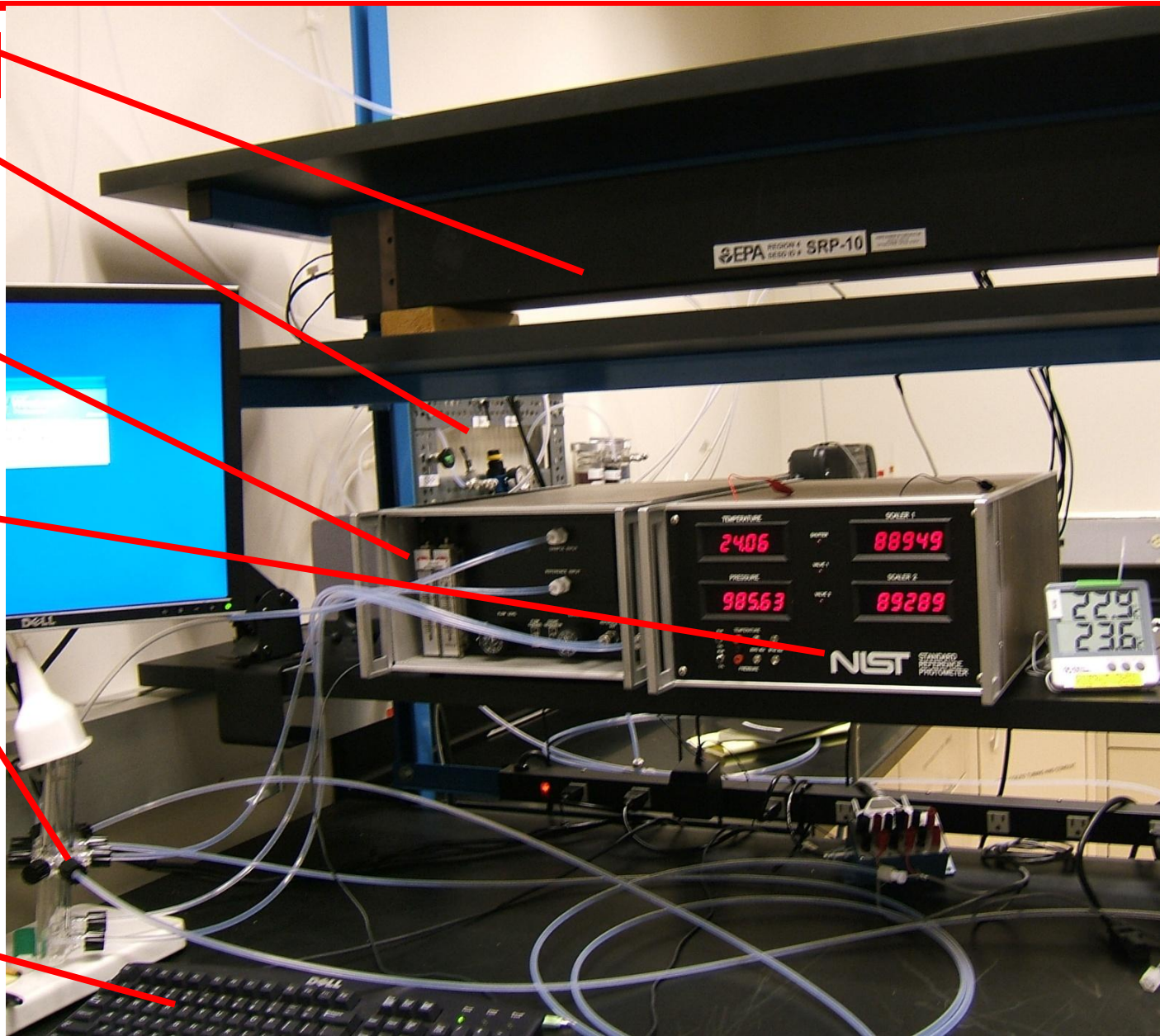
**Zero Air  
System**

**Pneumatics  
Module**

**Electronics  
Module**

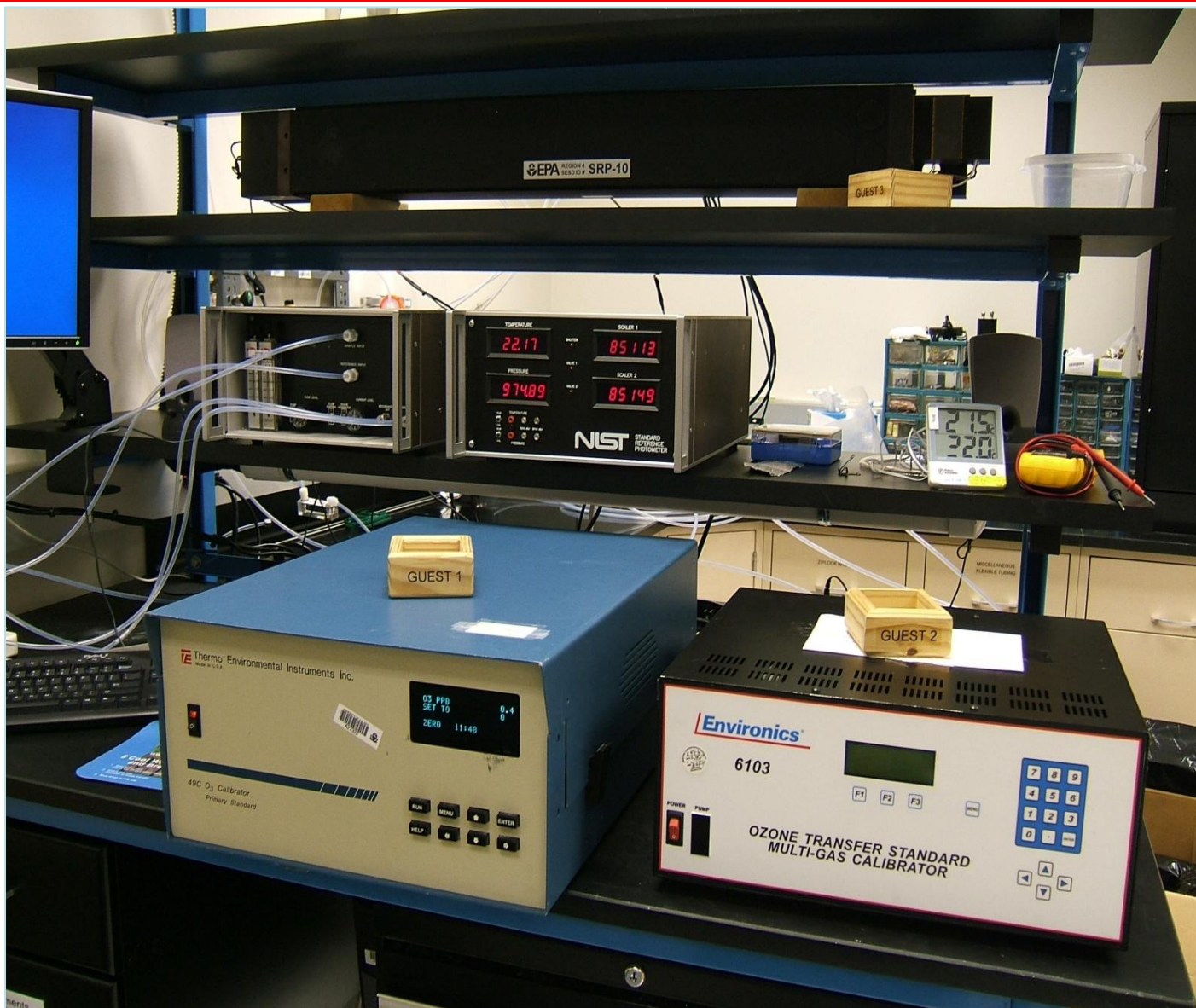
**Sample and  
Reference  
Manifolds**

**PC**



## Region 4 Air Monitoring Workshop

Tampa, Florida - 2011

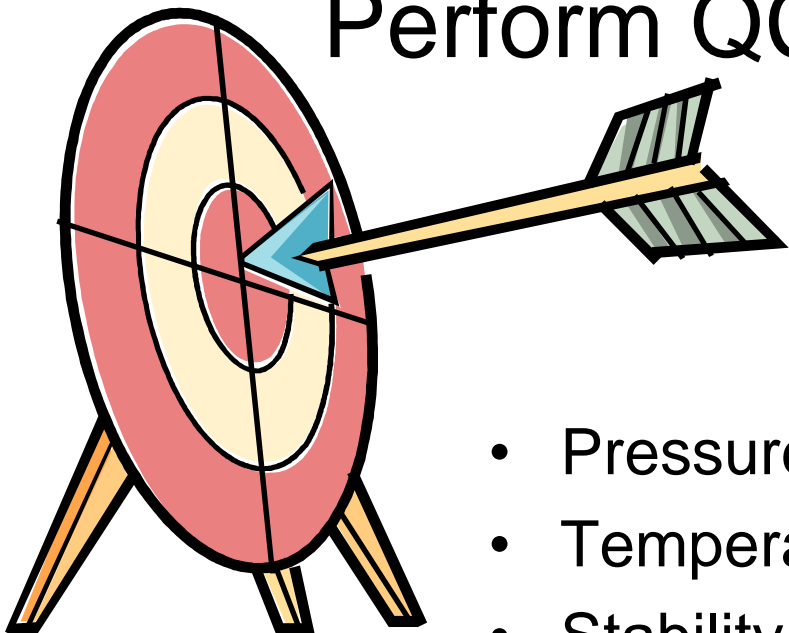


## **Steps for verification of Level 2 transfer standard:**

- 1) Perform QC checks on SRP
- 2) Configure plumbing for guest instrument.
- 3) Turn on guest instrument for warm up.
- 4) Configure guest instrument communication.
- 5) Run a few informal upscale concentrations (ozone conditioning).
- 6) Formal verification.



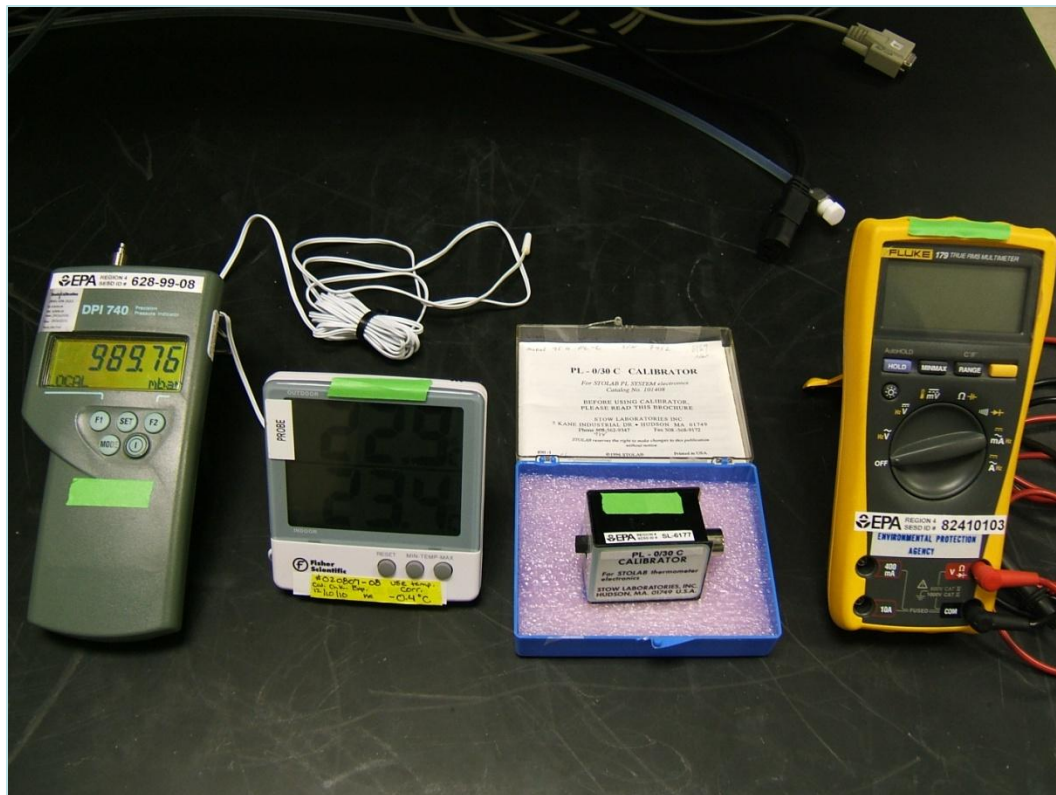
# Perform QC checks on SRP.



- Pressure must be accurate  $\pm 0.2$  mb.
- Temperature must be accurate  $\pm 0.1^{\circ}\text{C}$
- Stability: SD must be  $\leq 0.7$
- There are no ozone coefficients that can be adjusted on an SRP.
- It can take up to 3 hours to perform QC check.

# New at SESD in Athens...

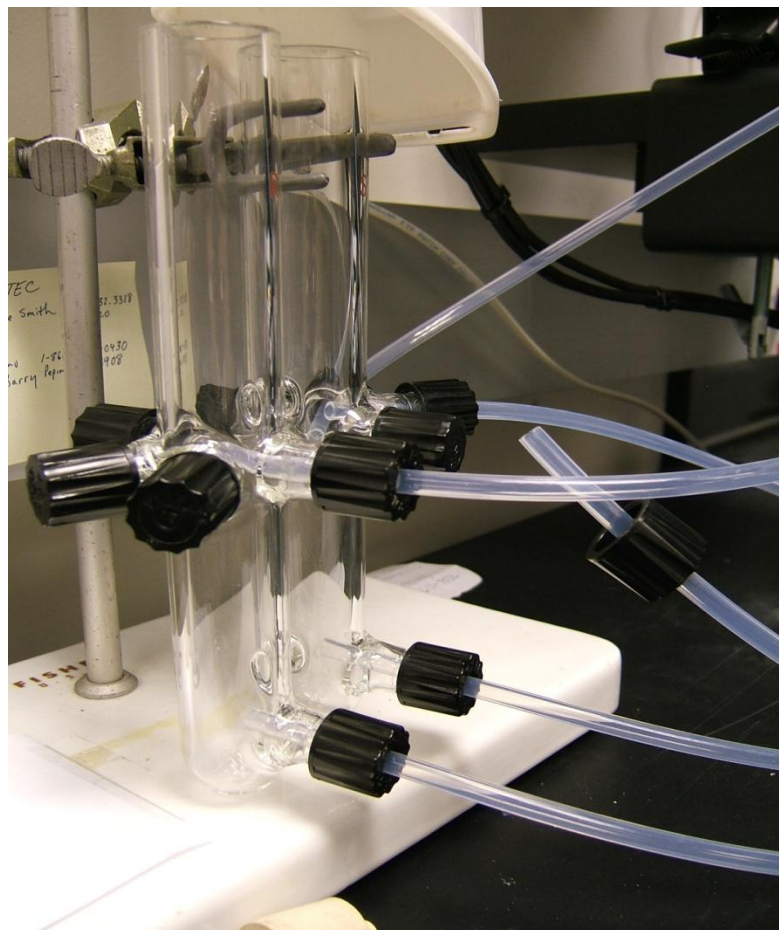
- ISO 17025 accreditation.
- All instruments that are used to verify the accuracy of the SRP are part of SESD's quality system, and are NIST traceable.





# Guest plumbing

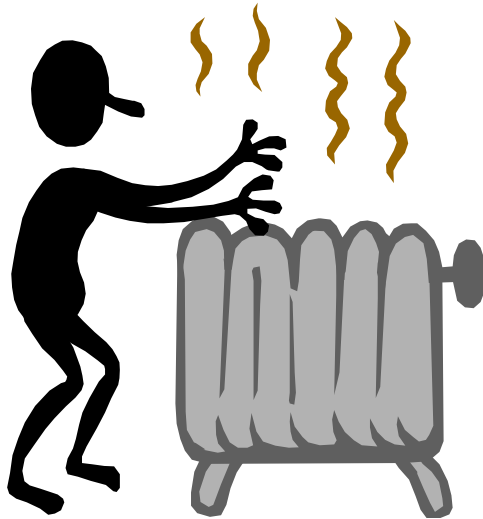
Zero Air  
(Reference)



Sample

**SRP Manifold**

# Turn on Guest for warm up.



- $\geq 1$  hour
- Includes 30 minutes ozone pre-conditioning

# Configure communication.

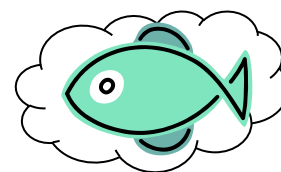
Three ways to get Guest instrument data into the SRP Control program.

1. Front Panel
2. Analog Outputs
3. Serial Port

# Configure communication.

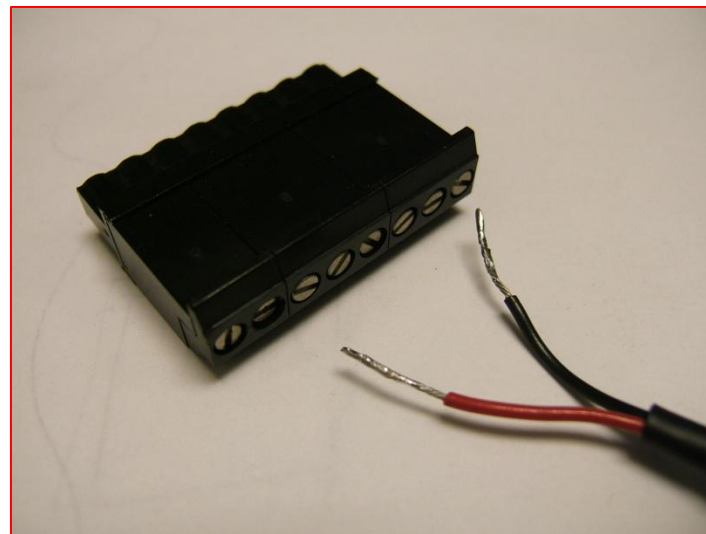
- Front panel

The front panel display is the “common denominator” for all users of the guest instrument. So, the goal is to collect data, that agrees with the front panel. But, nobody wants to have to manually enter an ozone value, EVERY 30 SECONDS for 3 hours.



# Configure communication.

- Analog Output
- This is a good way to collect data automatically.
- Most instruments are capable.
- The SRP Control Program may have to be “calibrated” to the analog outputs from the guest instrument.



Configure Connection

Analog Channel#  Volts

Conversion Slope

Conversion Intercept



# Configure communication.

- Serial Port
- This is BEST
- There are drivers available for most commercial instruments
- It typically agrees perfectly with the front panel



Configure Connection

Comm Port#

Baud Rate

Bits, Parity, Stop

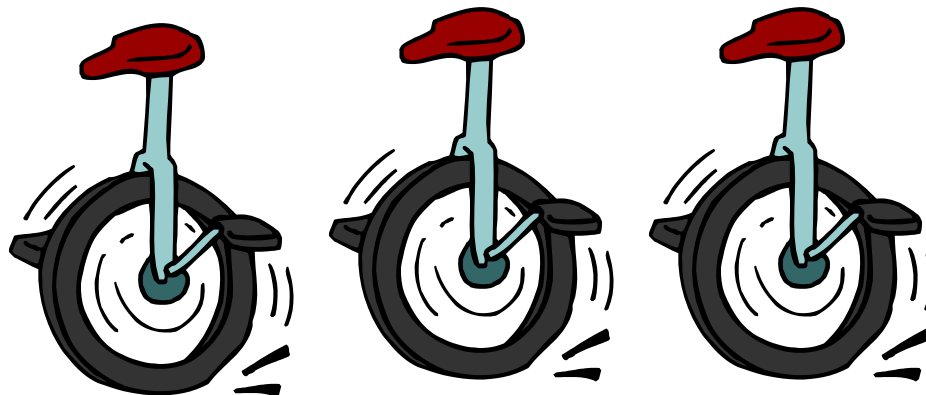
Inst Driver File

Instrument ID: (ASCII code = \#)

Password  O3 Generator ☐

# Annual Verification Minimum Requirements

A minimum of 3 cycles

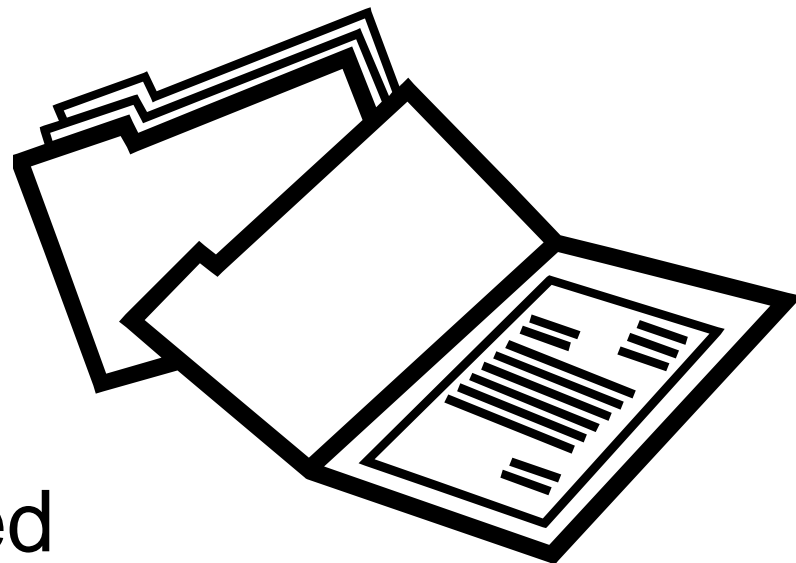


**1 cycle =**

- 6 upscale concentrations and one zero point.
- 7 replicate measurements of each point.
- Each cycle last about one hour.

# What you get...

- Individual “calibration reports” (one for each cycle)
- Summary Report
- Official paperwork is mailed to you



# Region 4 Air Monitoring Workshop

Tampa, Florida - 2011

## Standard Reference Photometer Calibration Report

**Calibrating Institute:** EPA Region 4  
**Operator:** Mike Crowe  
**Instrument:** SRP-10 Cell Length=89.84  
**Comment:**

**Date:** 14-Feb-11  
**Start Time:** 16:46  
**End Time:** 17:51  
**Filename:** c0214001.xls

<b>Calibrated Instrument:</b>	49CPS	<b>Calibration Results</b>	<b>Value</b>	<b>Standard Uncertainty</b>
<b>Owner:</b>	R4ESAT	<b>Slope</b>	1.00058	0.00041
<b>Contact:</b>	Jason Brown	<b>Intercept</b>	-0.49240	0.07039
<b>Make:</b>	TEI	<b>Covariance</b>		-4.2756E-08
<b>Model:</b>	49C Calibrator	<b>Res Std Dev</b>	0.15835	
<b>Serial Number:</b>	49CPS-72422-371			

**Calibration Parameters:** Zero Start&End;Raw Saved;Dark Count On (7)

**Air Flow Rate:** 6.0 l/min

**Lamp Intensity Range:** 0.0 to 40.0 %

**Number Conc. Points:** 8 **Points/Concentration:** 7

**Conditioning:** none

Calibration Data Points	SRP-10		49CPS		49CPS	
	Result	Std. Dev	Result	Std. Dev	Predicted	Residual
Dark Count 1	13					
Dark Count 2	9					
1	0.2	0.4	-0.3	0.1	-0.32	0.01
2	464.5	0.1	464.2	0.1	464.27	-0.03
3	94.3	0.4	94.1	0.2	93.82	0.27
4	68.1	0.2	67.4	0.1	67.63	-0.23
5	41.1	0.2	40.8	0.1	40.64	0.18
6	18.1	0.2	17.5	0.1	17.59	-0.07
7	9.8	0.3	9.3	0.1	9.35	-0.04
8	0.3	0.2	-0.2	0.1	-0.16	-0.09

### Ozone Transfer Standard Verification Summary Report



U. S. Environmental Protection Agency  
Region 4 Science and Ecosystem Support Division  
Enforcement and Investigations Branch  
Superfund and Air Section  
980 College Station Rd.  
Athens, GA 30605

	<b>EPA</b>	<b>GUEST</b>
	<b>Standard</b>	<b>Instrument</b>
Agency:	EPA Region 4	R4ESAT
Contact:	Mike Crowe	Jason Brown
Make:	NIST	TEI
Model:	SRP-10	49CPS
S/N:	10	49CPS-72422-371
Guest Test Status:		<b>PASS</b>
Guest Known Offset:		0

SESD Project #: 11-0257  
Test #: 1

Level 2	Slope	Intercept	R <sup>2</sup>	High O <sub>3</sub>	Lower O <sub>3</sub>
Averages:	1.0035	-0.4816	0.9999989	467	0
Upper Tolerance:	1.0300	3.0000			
Lower Tolerance:	0.9700	-3.0000			

Date Start	Time Start	Date End	Time End	File	Slope	Intercept	R <sup>2</sup>	Upper Range (ppb O <sub>3</sub> )	Lower Range (ppb O <sub>3</sub> )
02/14/11	4:46 PM	02/14/11	5:51 PM	c0214001.xls	1.0006	-0.4924	0.9999990	464	0.17
02/14/11	5:51 PM	02/14/11	6:57 PM	c0214002.xls	1.0035	-0.4975	0.9999989	466	0.09
02/14/11	6:57 PM	02/14/11	8:01 PM	c0214003.xls	1.0028	-0.4950	0.9999986	468	0.12
02/14/11	8:01 PM	02/14/11	9:06 PM	c0214004.xls	1.0045	-0.6201	0.9999997	467	0.28
02/14/11	9:06 PM	02/14/11	10:11 PM	c0214005.xls	1.0044	-0.3930	0.9999997	468	-0.01
02/14/11	10:11 PM	02/14/11	11:16 PM	c0214006.xls	1.0044	-0.4600	0.9999979	468	-0.02
02/14/11	11:16 PM	02/15/11	12:22 AM	c0214007.xls	1.0045	-0.4134	0.9999984	468	0.06

Comments: Instrument within tolerance.  
No adjustments made.  
Ozone calibration factors at time of test: Background = 0.2 Slope = 1.012



# What is a passing verification?

- Average slope of 0.97 to 1.03.
- Average intercept of  $\pm 3$  ppb.



Athens, GA 30605

	<b>EPA</b>	<b>GUEST</b>
	<b>Standard</b>	<b>Instrument</b>
Agency:	EPA Region 4	R4ESAT
Contact:	Mike Crowe	Jason Brown
Make:	NIST	TEI
Model:	SRP-10	49CPS
S/N:	10	49CPS-72422-371
Guest Test Status:		<b>PASS</b>
Guest Known Offset:		0

SESD Project #: 11-0257  
Test #: 1

Level 2	Slope	Intercept	R <sup>2</sup>
Averages:	1.0035	-0.4816	0.999999
Upper Tolerance:	1.0300	3.0000	
Lower Tolerance:	0.9700	-3.0000	

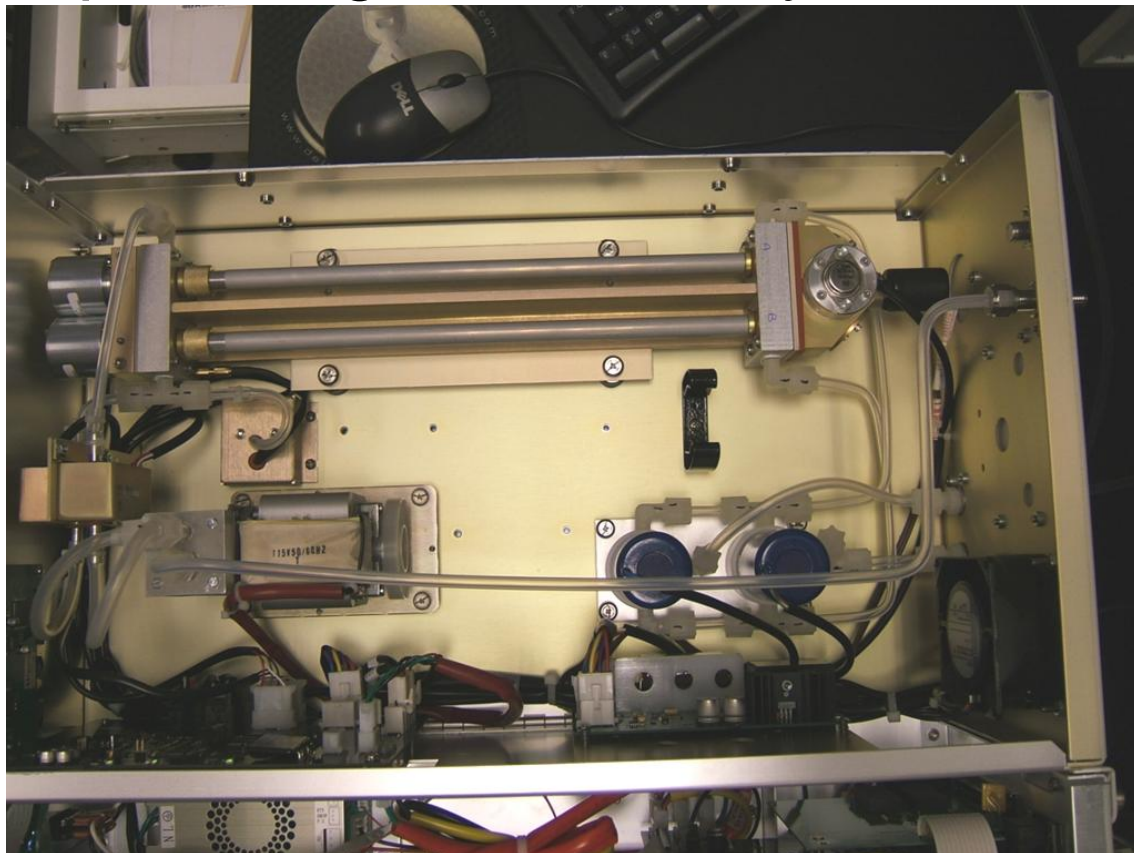
- Stability:  $SD \leq 2.0$

Date Start	Time Start	Date End	Time End	File	Slope	Intercept	R <sup>2</sup>
02/14/11	4:46 PM	02/14/11	5:51 PM	c0214001.xls	1.0006	-0.4924	0.999999
02/14/11	5:51 PM	02/14/11	6:57 PM	c0214002.xls	1.0035	-0.4975	0.999999
02/14/11	6:57 PM	02/14/11	8:01 PM	c0214003.xls	1.0028	-0.4950	0.999999
02/14/11	8:01 PM	02/14/11	9:06 PM	c0214004.xls	1.0045	-0.6201	0.999999
02/14/11	9:06 PM	02/14/11	10:11 PM	c0214005.xls	1.0044	-0.3930	0.999999
02/14/11	10:11 PM	02/14/11	11:16 PM	c0214006.xls	1.0044	-0.4600	0.999999
02/14/11	11:16 PM	02/15/11	12:22 AM	c0214007.xls	1.0045	-0.4134	0.999999

Comments: Instrument within tolerance.  
No adjustments made.

# Recent observations

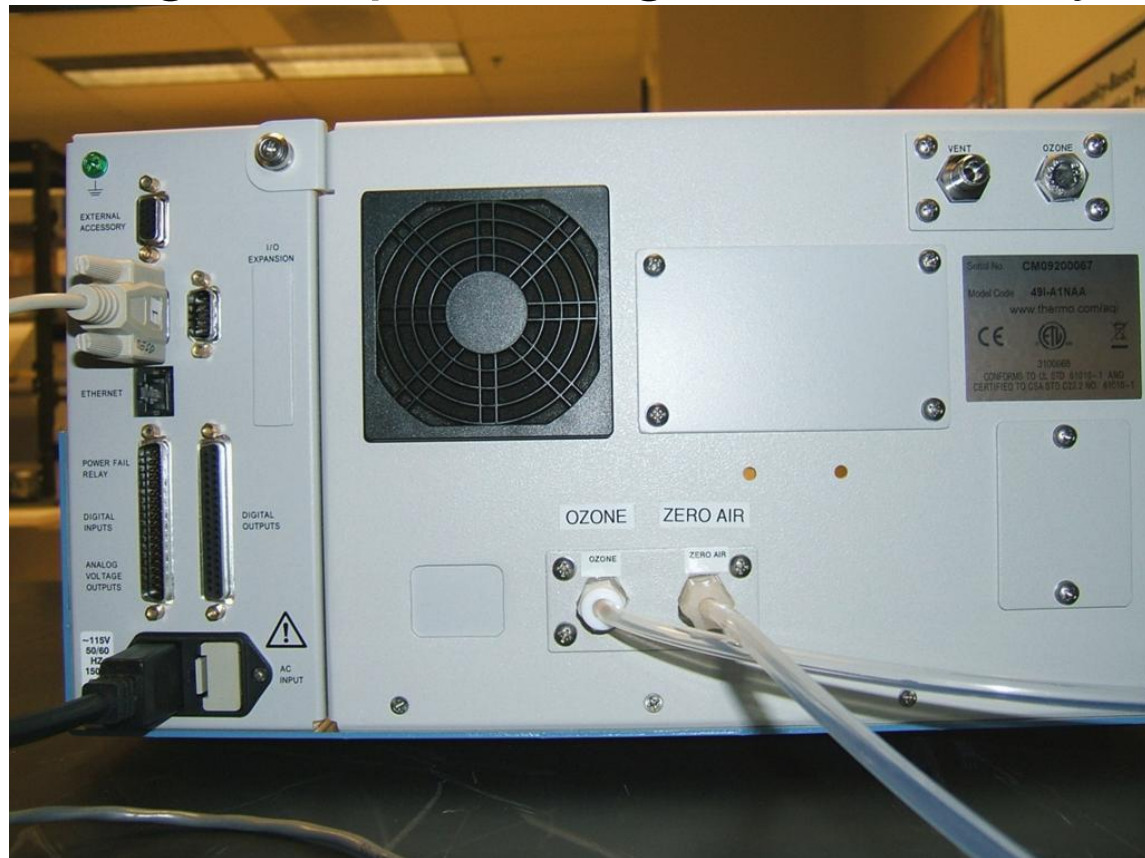
- Some organization are converting analyzers into standards: Slight re-plumbing is necessary
  1. Removal filter / ozone scrubber on reference side, and plumbed to the rear bulk-head.
  2. The level 2 transfer standard must use the same zero air as the SRP during verification.



# Recent observations

- Some organization are converting analyzers into primary standards: Slight re-plumbing is necessary

3 . Ensure that the photometer is not pressurized by zero air. Installation of a Tee is common. A minimum of 1 lpm excess is required.



Do you notice anything unusual with the slope and intercept?

[illegible]



# Recent observations



- There is evidence that ambient (unfiltered) air may be entering some photometers.

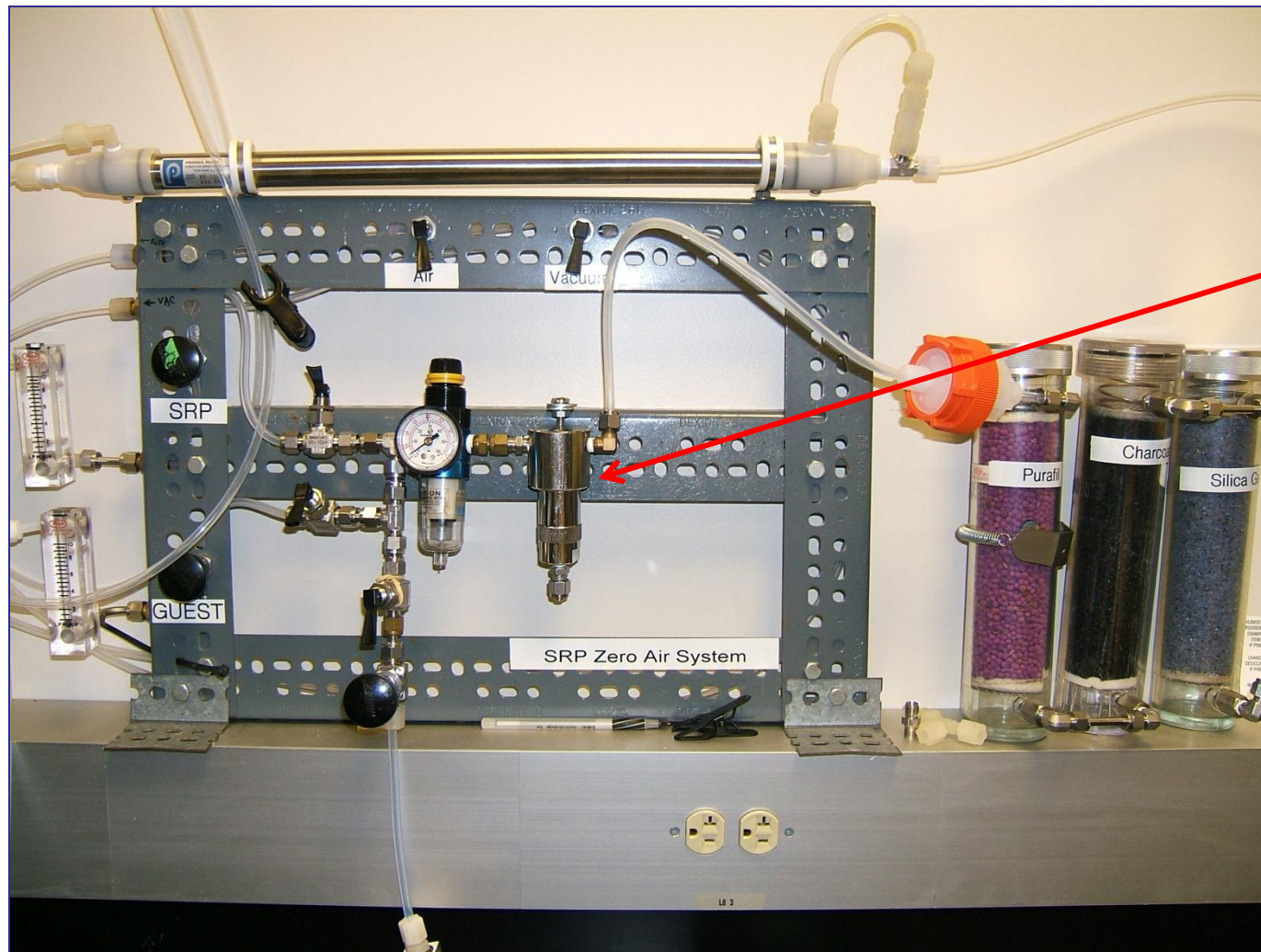
Reminder: Turn off photometer pump or install particulate filters as necessary.



Cleaned photometer cells, conditioned with ozone, tried again.

				Make:	NIST						
				Model:	SRP-10						
				S/N:	10						
SESD Project #:	11-0325			Guest Test Status:	PASS						
Test #:	2			Guest Known Offset:	0						

# SRP Zero Air System



**A 0.01 micron  
membrane  
cartridge filter  
is the final  
step for  
creating zero  
air.**

# Recent observations

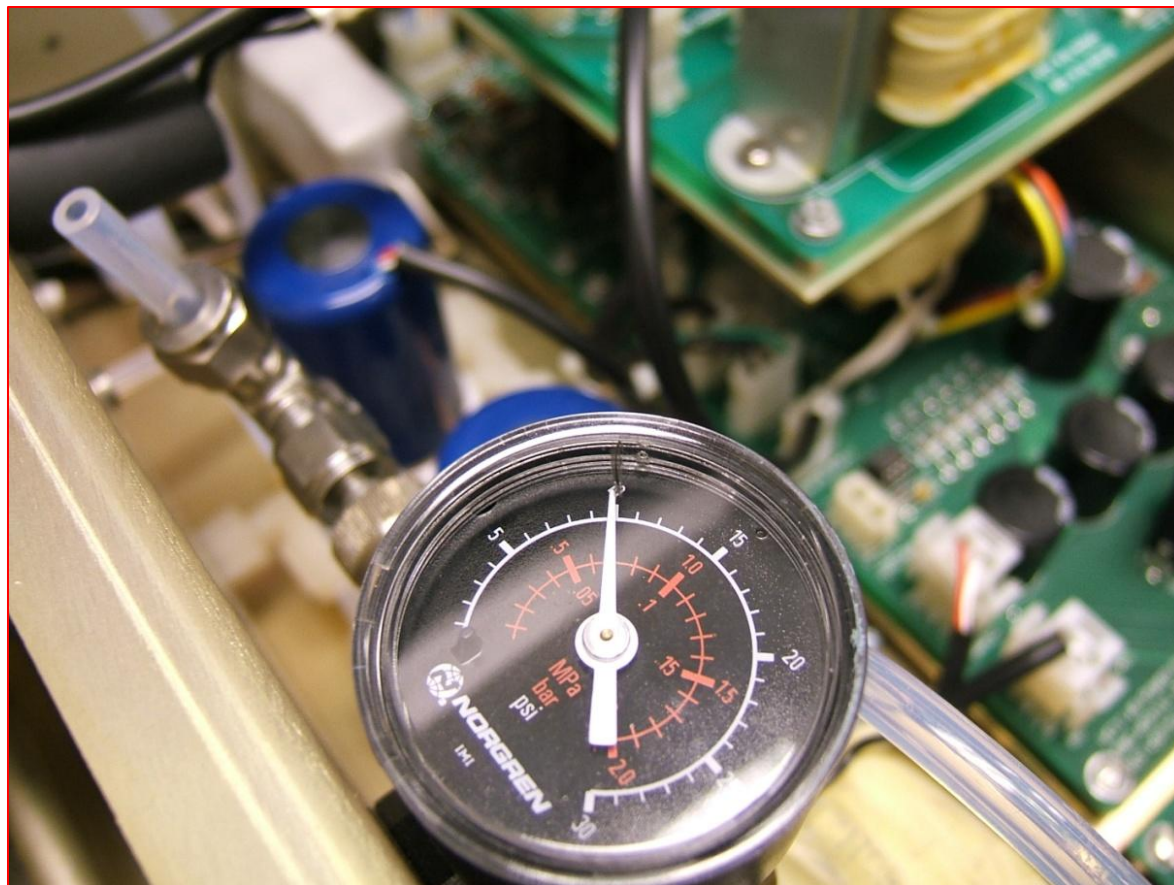
- Zero drift with changes in pressure.
- The SRP zero air is typically supplied at ~25 psig / up to 4 lpm.





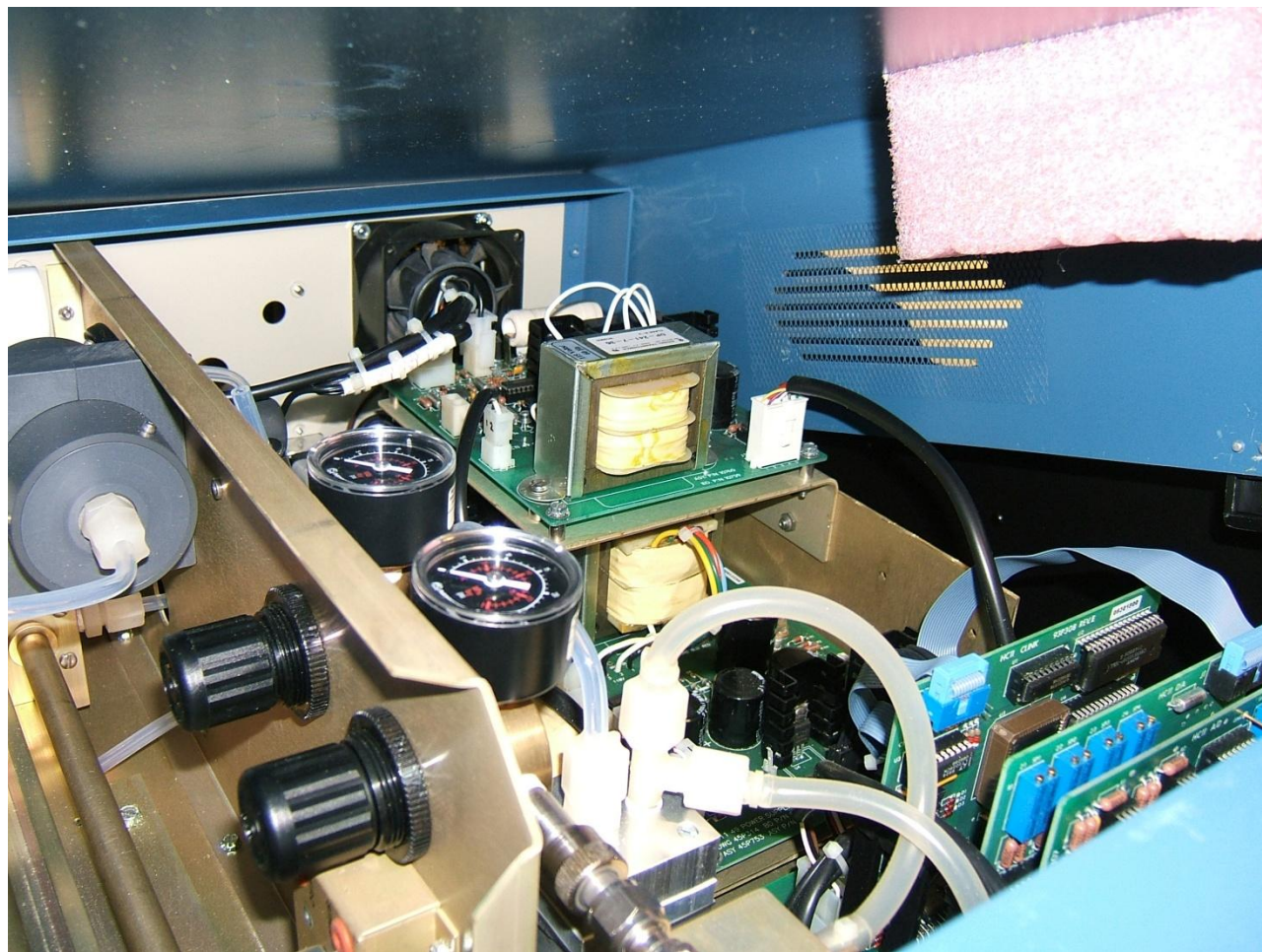
# Recent observations

- Marking the zero air pressure gauge is common.



# Recent observations

- Circuit boards coming loose during shipping.
- Add bubble wrap to inside, and leave me a note.
- Ship instrument to Athens, then make a day-trip to retrieve it.



**Bring two...**

**Our unofficial policy is that we will verify  
two instruments for each agency.**

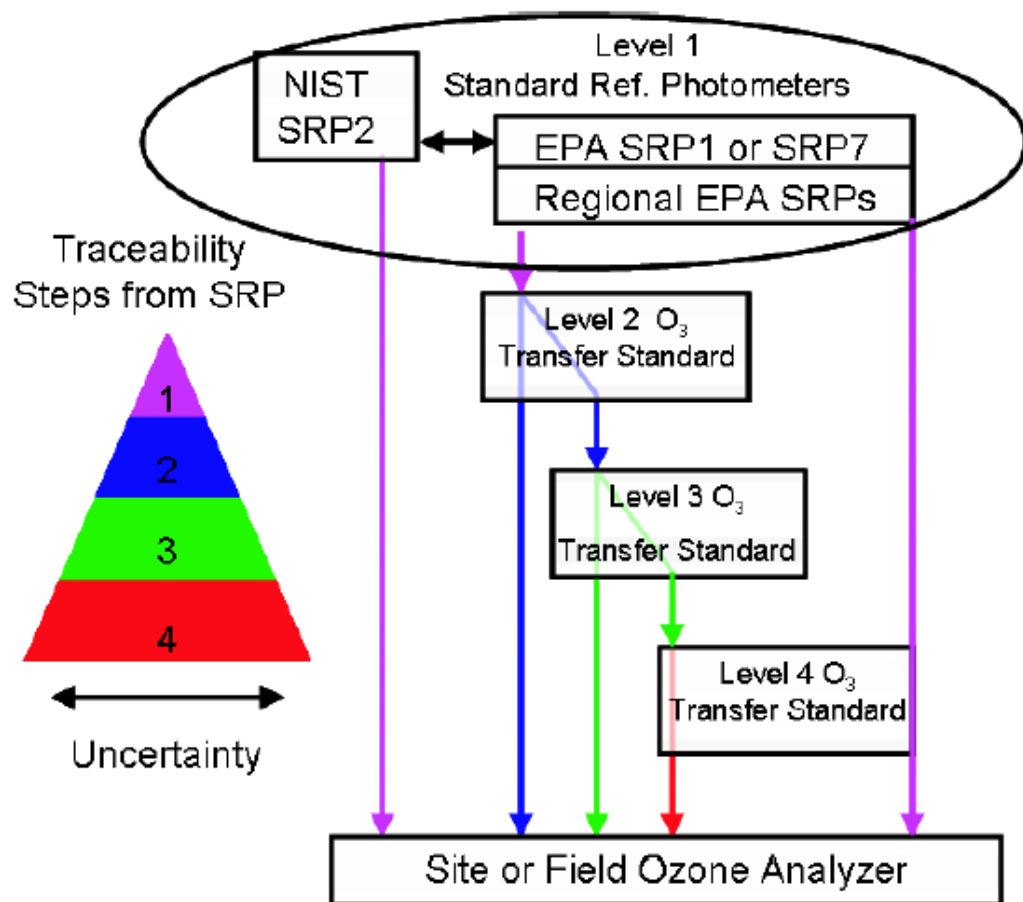
# New guidance has arrived!



- Replaces 1979 document
- Removed old analytical methods for ozone
- Uses the term “verification” instead of “certification”
- Refers to “levels” of transfer standards



# Levels of ozone transfer standards



- Levels based on “distance in the traceability chain” from the SRP.

- There is a separate SOP (being revised) for Level 2 verifications, using the SRP.

# ***Questions??***

***Mike Crowe***

***USEPA, Region 4 SESD***

***[crowe.mike@epa.gov](mailto:crowe.mike@epa.gov)***

***(706) 355-8630***